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NATIONAL LABORATORY

MAMBO Institutional Computing Progress Report
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This project is focused on producing models of the emission from both thermonuclear and core-collapse supernovae to produce background signals that will be detected by the MAMBO cubesat (DR led by Peter Bloser). In this past year, the focus of the computer time used on the w21_mambo allocation has been to calculate a grid of gamma-ray signals from thermonuclear supernovae. We also developed a few preliminary simulations of core-co

1) Work with Dieter Hartmann and his students (Clemson University) to use these models to calculate the background signal for the MAMBO satellite. We provided a first suite of models to Dieter and his students are working on the integrated background emission both for a publication and to provide the data to interpret the MAMBO data once this satellite is launched. Dieter's students plan to visit LANL this summer.
2) These simulations were also used in the LOX satellite proposal submitted to the midex round this past November (LA-UR-19-26900). Our collaborator and PI of the LOX mission (Rich Miller at Johns Hopkins University) is working with us to put together two publications on these results (we are putting together the final calculations now – which may take until the summer to complete).
3) This year, we learned that the small-explorer COSI satellite was approved (PI – John Tomsick at UC Berkeley, to be launched in 2025). Fryer is part of the science team for this satellite and the time-dependent signals from this study will not only contribute to the nucleosynthesis study of this project (working with Dieter Hartmann) but also potential transient studies with this satellite. For these transient studies, we are working with Eric Burns (Louisiana State University). We hope to complete at least one, of not two, papers relevant to COSI this year.
4) Also with Eric Burns, we have worked on a white report for the Snowmass meeting. This paper is in production as we speak.

As you can see above, one of the strengths of this proposal is the broad impact the simulations will have with the results used by multiple groups, providing a broad range of ties with the academic community. Figure 1 shows the multiple satellite missions supported under this project. Although we have no submitted papers to date, we expect to finish 3-5 papers before the end of the fiscal year.

This work is funding under the MAMBO LDRD DR led by Peter Bloser and is funded through this work. However, the broad application of this science has facilitated a broad set of further follow-on funding. The fact that COSI was selected means that, starting in 2024, we will receive NASA funds to continue this work. If LOX is selected, we will receive further funding from that satellite mission.

Figure 1: Different satellite missions supported by the simulations in this study: LOX (exhibit 8 from proposal), COSI mission, and MAMBO.

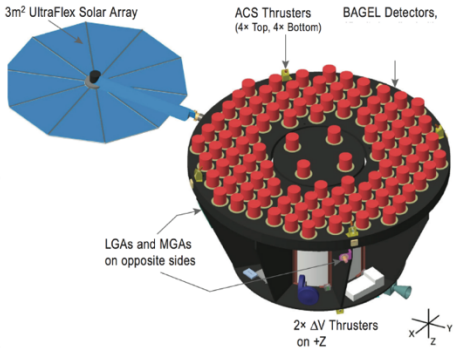

Exhibit 8. LOX spacecraft concept. The BAGEL instrument (red) is an array of high-heritage gamma-ray spectrometers.

COSI

Fig. 1: MAMBO combines a new, well- shielded gamma-ray detector with a low- mass CubeSat platform to achieve unprecedented sensitivity to the MeV CDG.